MODIS Science at UW

May 1999

* Cloud Mask Adjustments

* Surface Emissivity and Soundings

* WINTEX

* Cal/Val Opportunity at the South Pole

* Direct Broadcast Reception Capability at UW

Recent Updates to the Cloud Mask (MOD35)

•Generation of granule based clear sky radiance files. Testing of eight day composites with AVHRR shows improvements in persistent cloud regions.

•Error in desert processing paths found and fixed.

•Use of the Near Real-Time SSM/I Daily Global Ice Concentration and Snow Extent map as ancillary data input for nighttime use.

•Logic for Q/A quality flag updated based upon number of tests applied and processing paths.

•Spectral test thresholds moved from include files to input data files. Can now update thresholds and re-process without having to recompile.

•User defined granule sub-sets can now be processed for debugging purposes.

•Code has been thoroughly tested for robustness.

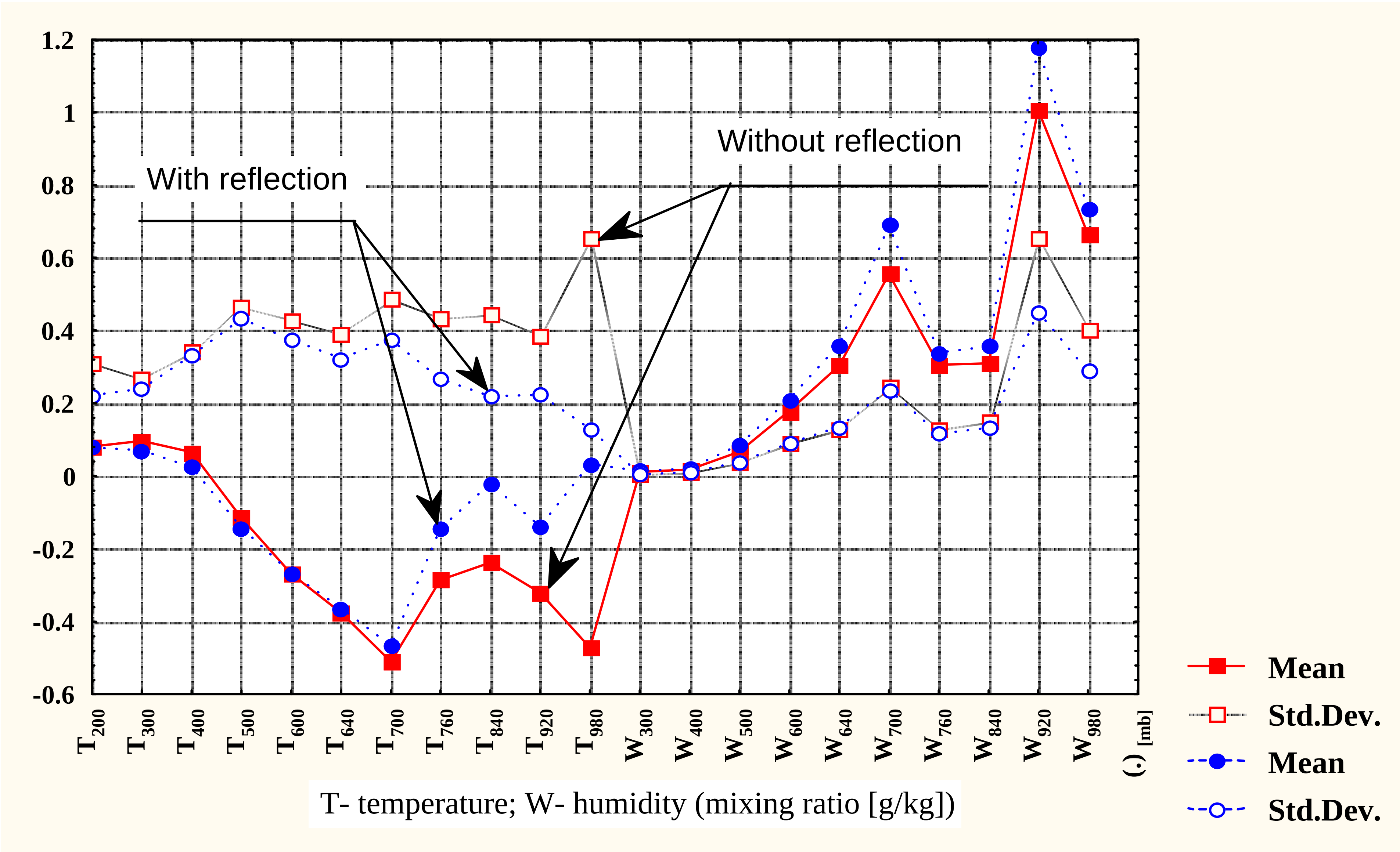
Surface Emissivity and Soundings

* Collaborative effort with Zhengming Wan

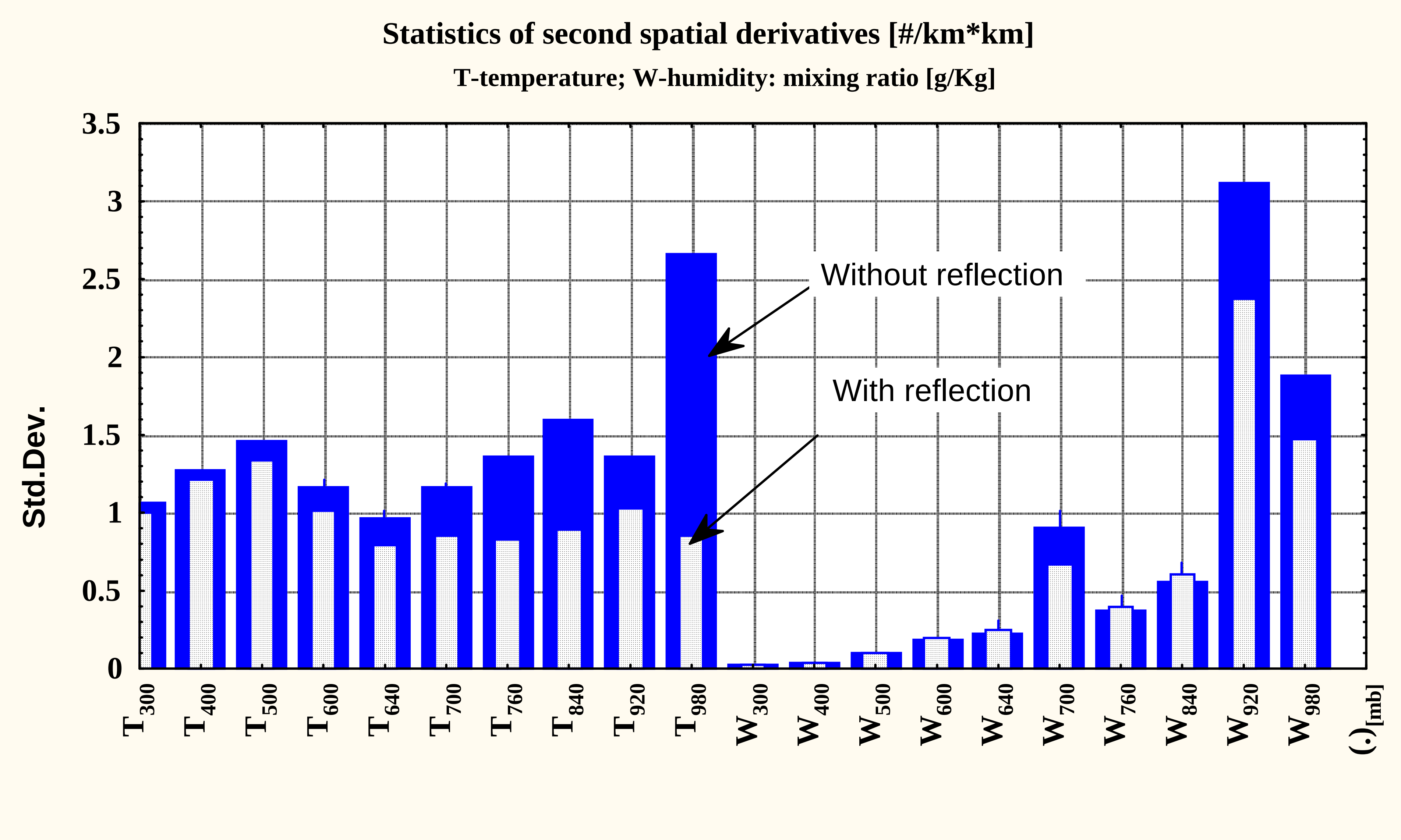
* Simultaneous solution of T(p), Q(p), Ts, εswir,
and εlwir

* boundary layer T and Q adjusted most

* atmospheric profiles smoother from FOV to FOV



1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
With reflection
Without reflection
T_{200} T_{300} T_{400} T_{500} T_{600} T_{640} T_{700} T_{760} T_{840} T_{920} T_{980} W_{300} W_{400} W_{500} W_{600} W_{640} W_{700} W_{760} W_{840} W_{920} W_{980}
$(\cdot)_{[mb]}$
T- temperature; W- humidity (mixing ratio [g/kg])
Mean
Std.Dev.
Mean
Std.Dev.



Statistics of second spatial derivatives [#/km*km]
T-temperature; W-humidity: mixing ratio [g/Kg]
Std.Dev.
3.5
3
2.5
2
1.5
1
0.5
0
Without reflection
With reflection
T300
T400
T500
T600
T640
T700
T760
T840
T920
T980
W300
W400
W500
W600
W640
W700
W760
W840
W920
W980
(·)[mb]

Science Flights during WINTEX

Cloud Studies

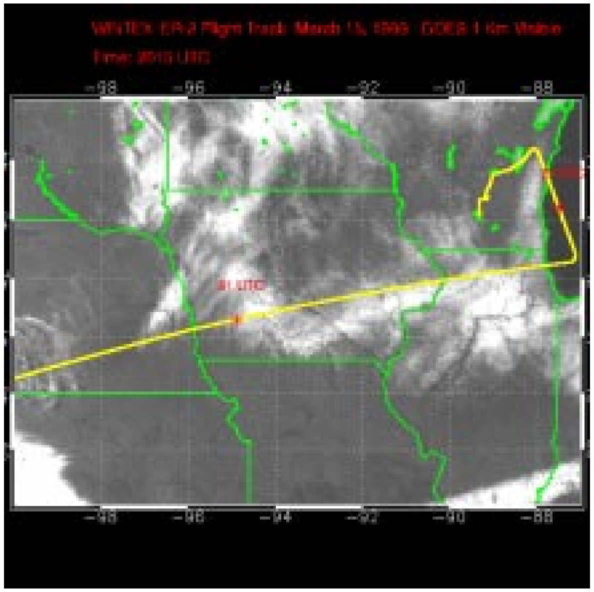
March 31 – Cloud (Cirrus) properties
April 1 – Cloud properties, water vapor structure, low cloud (IA), sfc emissivity
March 20 – High Cloud Detection in low illumination conditions
March 18 – Cloud Detection over urban MKE

NOAA K Underfly

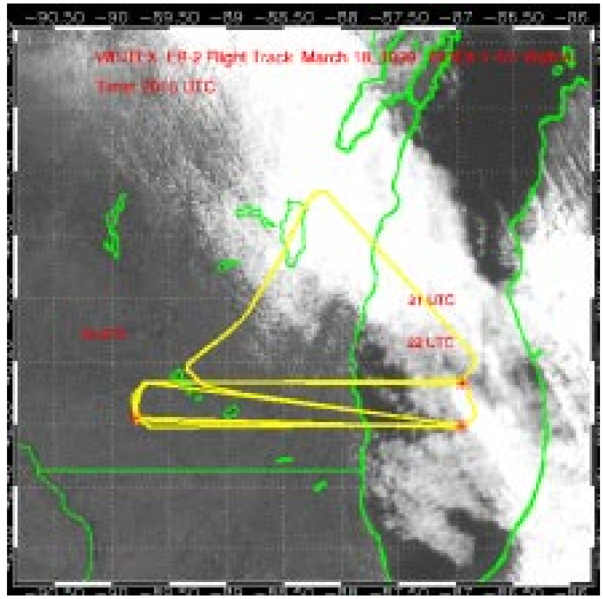
March 29 – NOAA-15, MAS calibration comparison to S-HIS and NAST-I
March 25 – NOAA-15, MAS calibration comparison to NAST-I
March 26 – mid and high cloud detection in low light, sfc emissivity

Clear Soundings with NAST

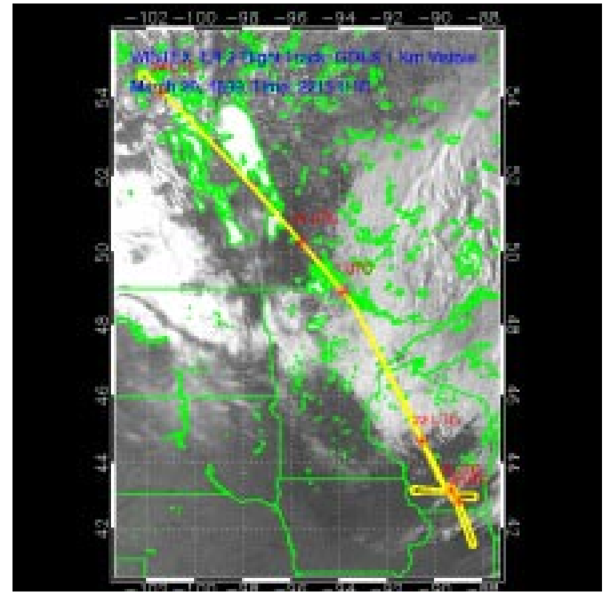
March 18 - Clear sky sounding with ground truth
March 20 - Night-time clear sky sounding with ground truth
March 26 - Night-time clear sky sounding with ground truth



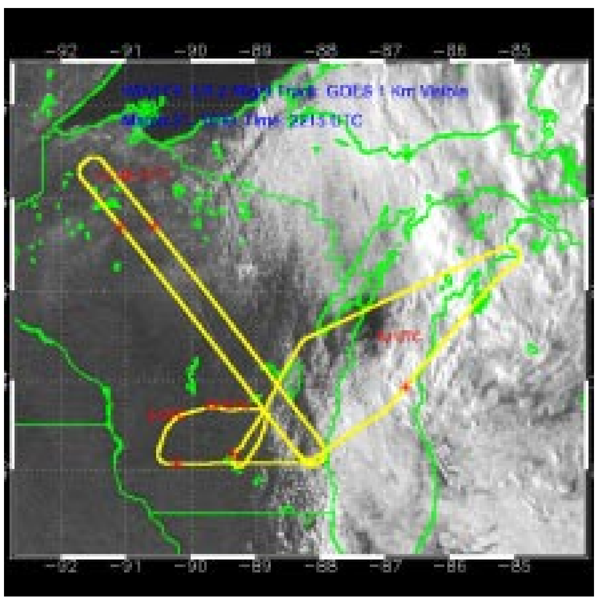
March 15 ,1999



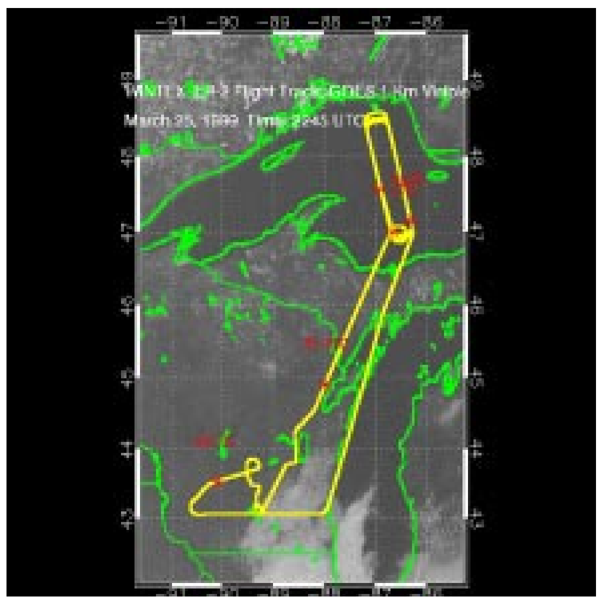
March 18 ,1999



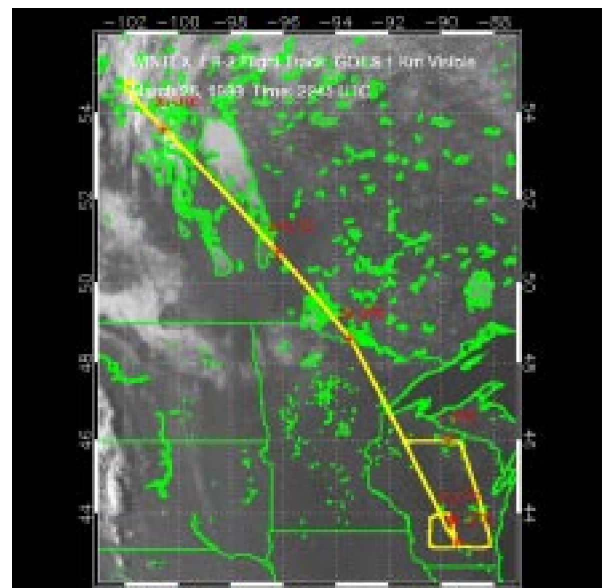
March 20 ,1999



March 21 ,1999

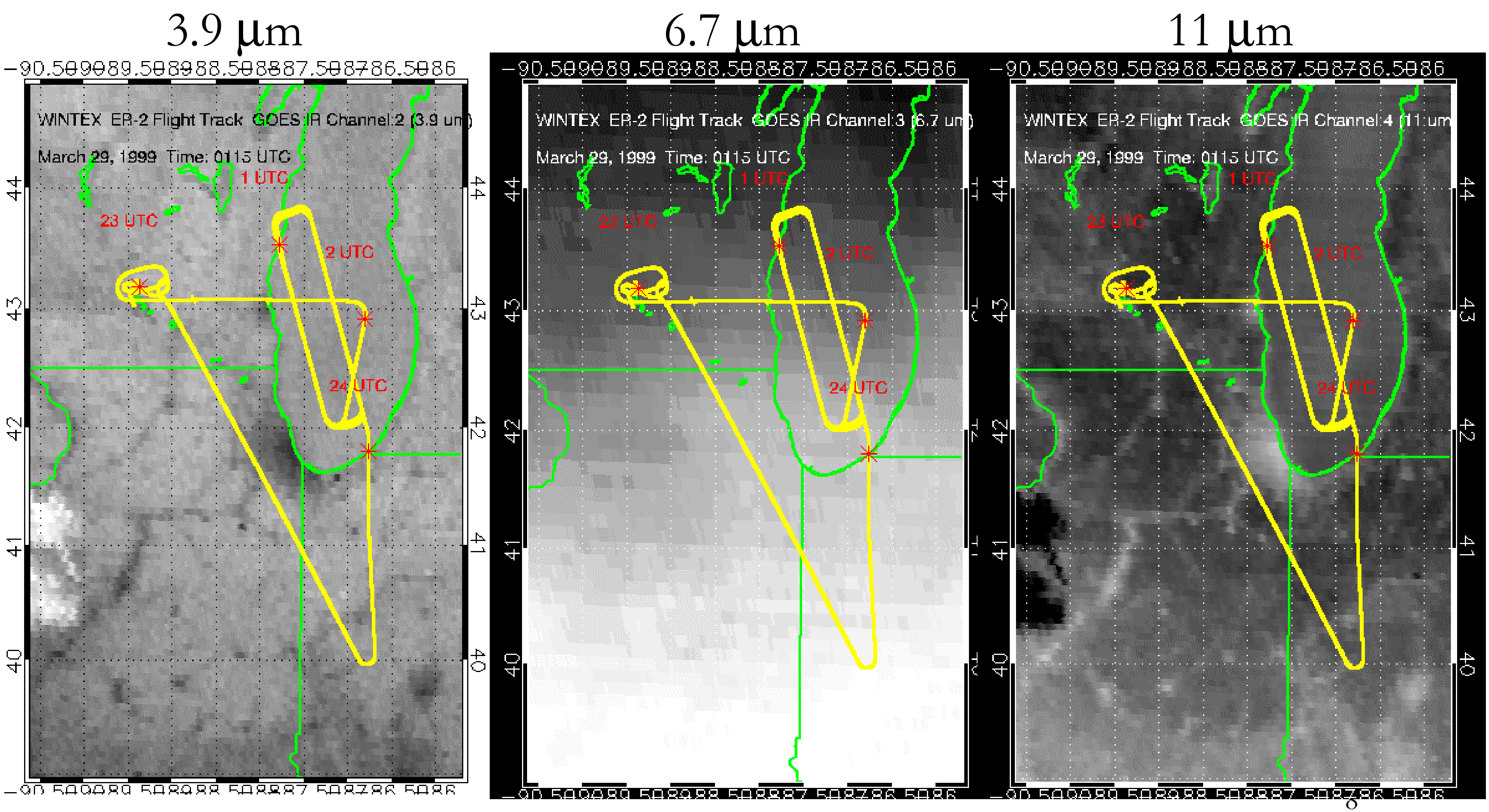


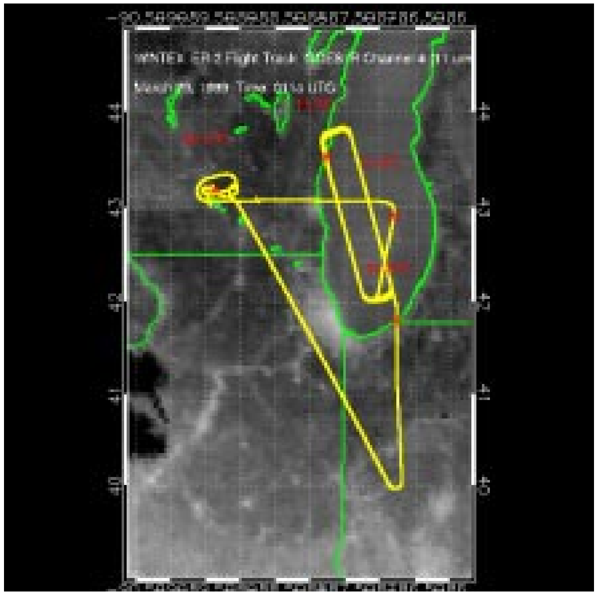
March 25 ,1999



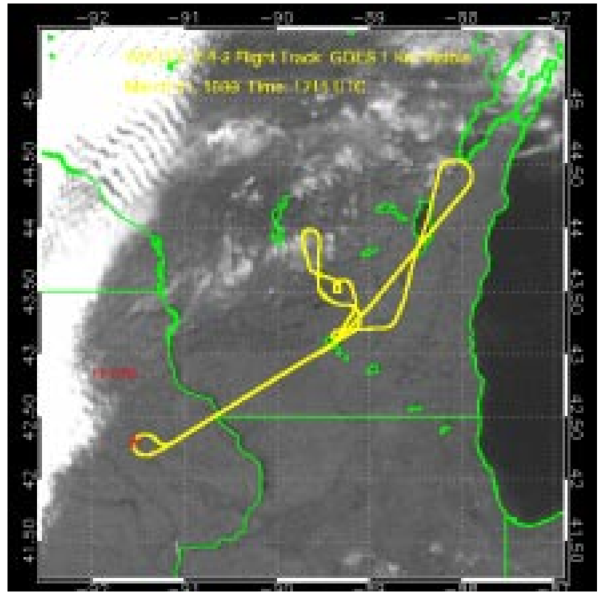
March 26 ,1999

WINTEX March 30, 1999 1:15 UTC GOES Imager

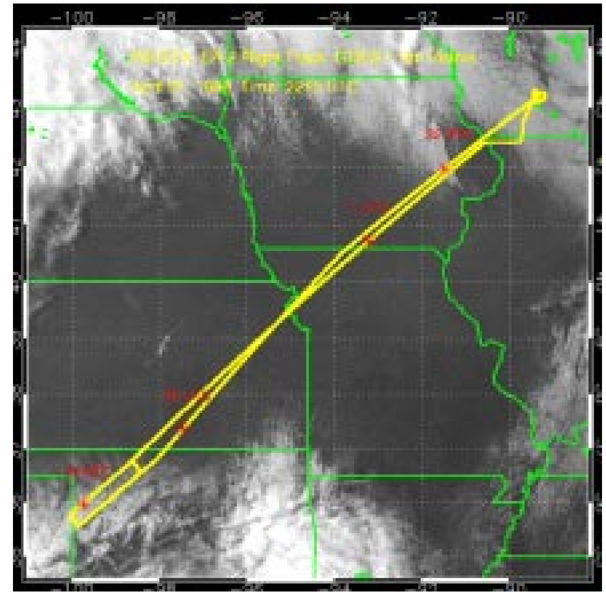




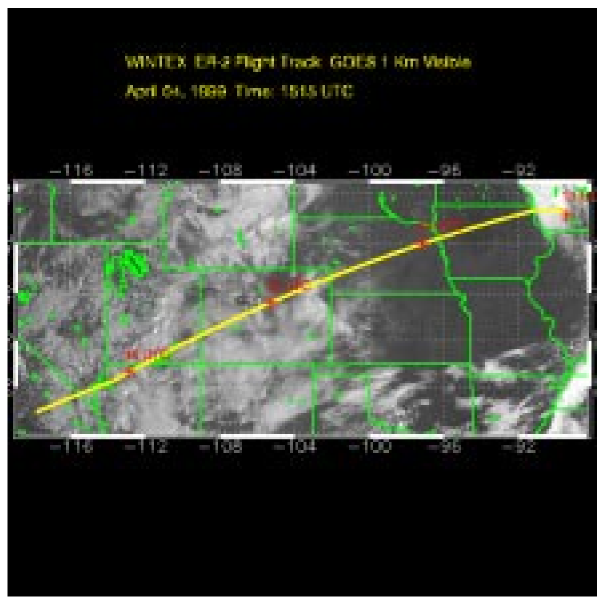
March 29, 1999



March 31, 1999

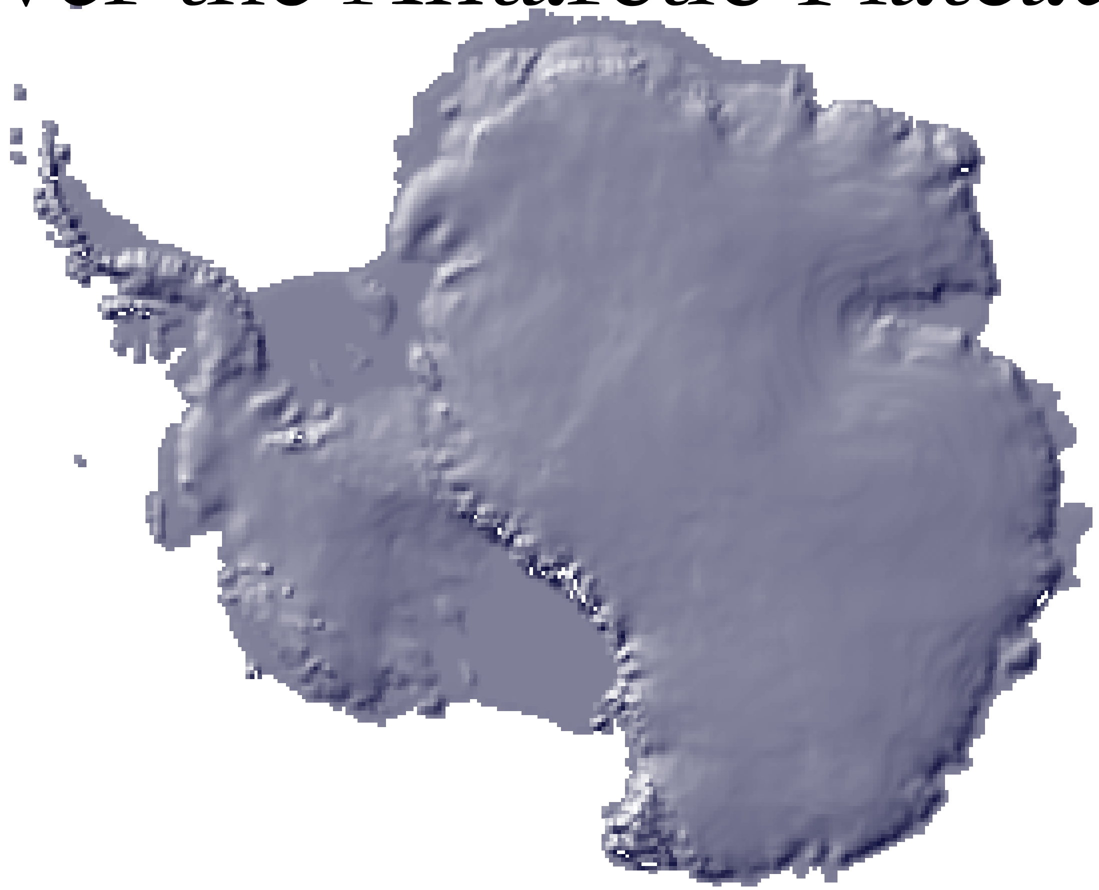


April 1, 1999



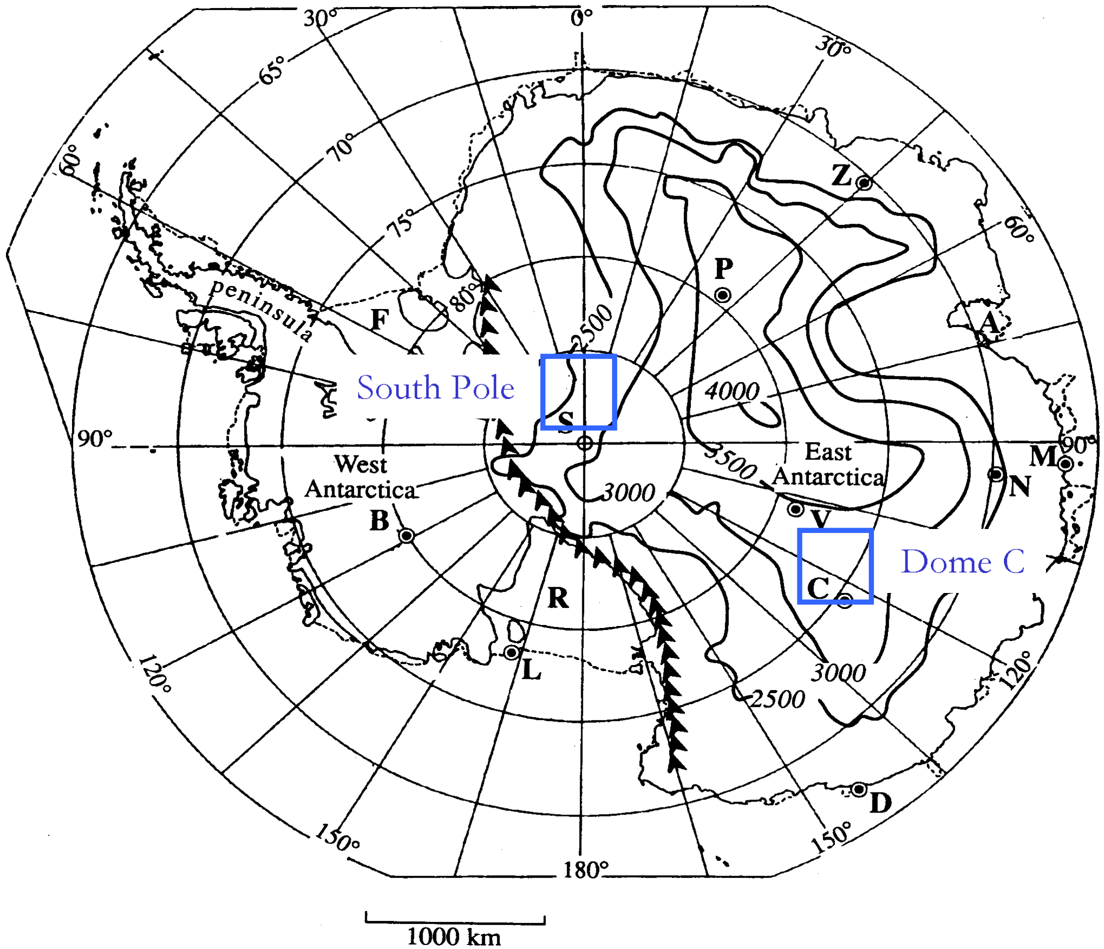
April 4, 1999

MODIS Vicarious Calibration over the Antarctic Plateau



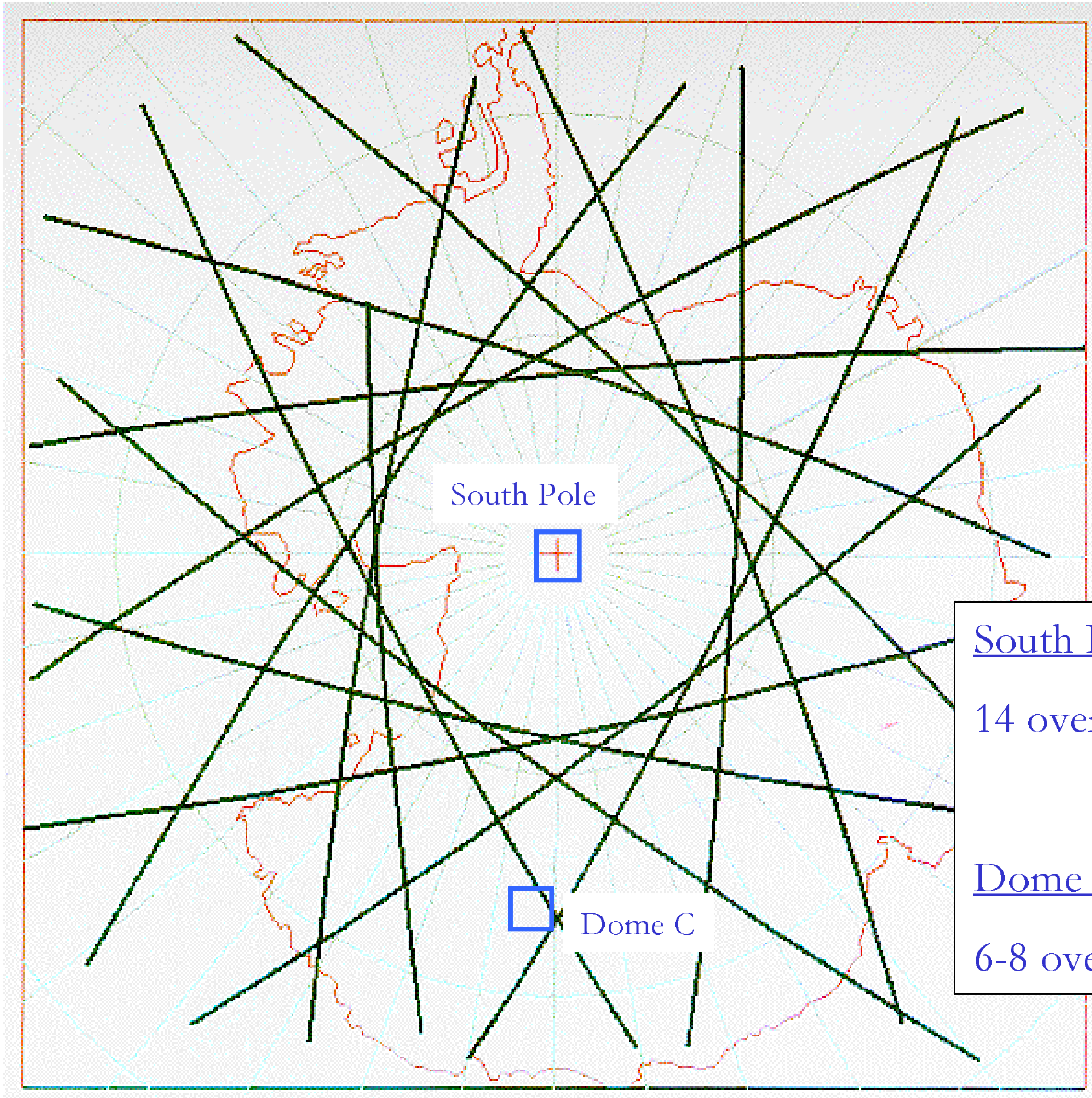
Von P. Walden and Fred Best
University of Wisconsin-Madison
Steve Warren
University of Washington

Cal/Val Sites in Antarctica



Map of Antarctic. Contours of elevation are shown, beginning at 2,500 meters. Locations mentioned in the text are indicated by symbols: Amery Ice Shelf (A), Byrd Station (B), Dome-C (C), Cape Denison (D), Filchner-Ronne Ice Shelf (F), Little America (L), Myrnyy (M), Pionerskaya (N), Plateau Station (P), Ross Ice Shelf (R), South Pole (S), Vostok (V), Mizuho (Z), Trans-Antarctic Mountains (^).

Simulated MODIS Overpasses



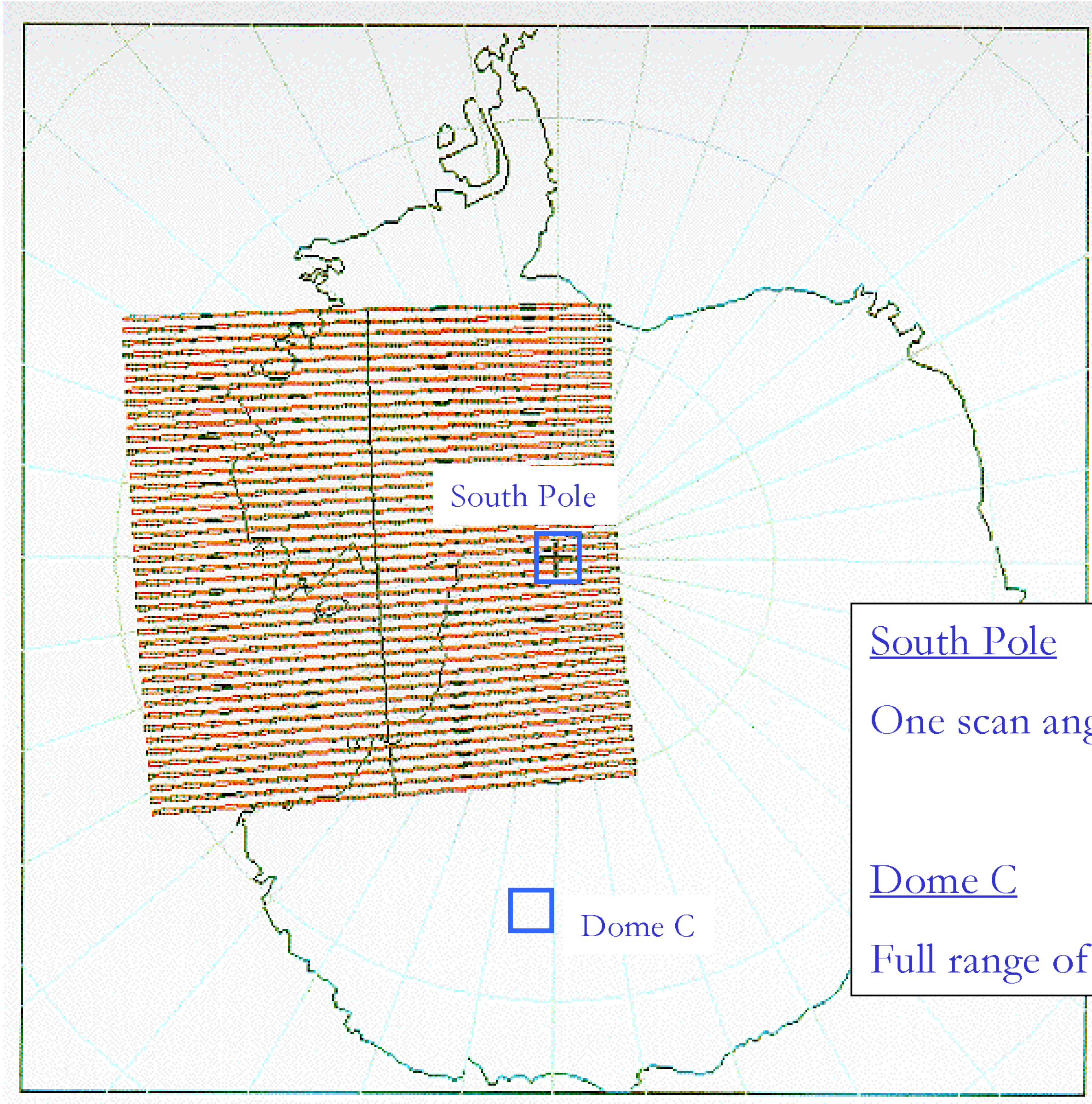
South Pole

14 overpasses/day

Dome C

6-8 overpasses/day

MODIS Ground Scan Patterns



South Pole

One scan angle (48°)

Dome C

Full range of scan angles

MODIS Vicarious Calibration

$$L_{up} = [\varepsilon * B(Ts) + (1-\varepsilon) * L_{down}] * \tau + E$$

where	L_{up}	- upwelling radiance at instrument
	ε	- surface snow emissivity
	B	- Planck radiance
	Ts	- surface skin temperature
	L_{down}	- downwelling radiance at sfc
	τ	- atmospheric transmission
	E	- atmospheric emission from sfc to obs

All variables are functions of frequency except Ts. All functions are also functions of viewing angle except B and Ts.

Measurement Methodology

1) Measure [ε * B(Ts) + (1-ε) * Ldown] and Ldown at the MODIS view angle with the ground-based PAERI.

   Measure the spatial variability of Ts using narrowband radiometers; check spatial variability threshold.

2) Assemble model atmosphere using sonde information (T, H2O, O3) and surface concentrations of trace gases (CO2, N2O, CH4, CFCs).
3) Compare Ldown with LBLRTM calculations. Adjust model atmosphere, if necessary (gas profiles, diamond dust).
4) Calculate τ and E using model atmosphere.
5) Calculate the upwelling radiance at TOA (Lup) using measured surface emission and model atmosphere.

Uncertainties in L_{up} at TOA

- σ([ε * B(T_s) + (1-ε) * L_{down}]) is < 0.05 K of ambient blackbody radiance
  - same σ as MAERI for SST
  - comparison with NIST standard

- σ(τ) is negligible in transparent bands such as 29, 31, 32

- σ(E) = 0.05 K (29), 0.01 K (31,32) and 0.2 K (33; CO_2)
  - main contributors are uncertainties in T and H2O profiles

EOS Direct Broadcast at SSEC: Goals

Acquire and use EOS direct broadcast data to

1. Provide regional users with near real-time products,
2. Assist MODIS validation by supporting field campaigns,
3. Provide outreach to the non-EOS community.

Develop a MODIS direct broadcast data processing package to

1. Provide software to transform Level-0 to Level-1B and a selection of geophysical products,
2. Enable the international community to directly participate in MODIS calibration and validation.

EOS Direct Broadcast at SSEC: Status

Proposal funded by NASA HQ.

Plans and approvals for antenna, radome, and tower on SSEC roof are on target for completion by end of May.

Bid package for antenna, radome, processing electronics and hardware (to produce Level-0 data) will be released next week; award will occur in June.

Level-1 software development is underway (Tom Rink is lead developer).

Plan to have system routinely acquiring data by end of 1999 (products will include Level-1B, Cloudmask, and Web Quicklooks, all within 1 hour of overpass).